Sustainable development in agriculture: Definition, barriers and consequences for Ukrainian agricultural producers*

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Abstract

The paper aims to identify the views of Ukrainian agricultural producers and scientists on sustainable development in agriculture, its consequences and barriers faced by Ukrainian producers. Two surveys were done in 2021–2022. The exploratory (qualitative) study was conducted through a semi-structured interview carried out with 19 agricultural producers, who relate their businesses to sustainable practices and represent different Ukrainian regions. Based on the content analysis, we have found out how sustainable development is defined by actual producers operating in Ukrainian agriculture, barriers to the implementation of relevant practices, and consequences for the sector. Almost all statements of farmers are correlated with existing theoretical developments. In a second step, we conducted a survey with 142 scientists in the field of agriculture, who assessed on a 5-point scale whether certain sustainable practices, barriers and consequences are inherent to agriculture in Ukraine. The research has identified the dimensions of sustainable business development that suggest progressive changes and incorporation of a balanced approach to achieving goals into companies' operating strategies. It means balancing growth in demand and limited consumption, high profits and necessary investments in sustainability (safety, working conditions), experimental science and farmers' on-the-ground knowledge.

Keywords: Sustainable development, Agriculture, Agricultural producers, Sustainable management, Ukraine
JEL Codes: Q01, Q1, M 11, M19

1. Introduction

Agricultural activity is one of the biggest sources of a country's financial wealth, which generates income and provides employment for many people. It is estimated that 1.3 billion out of 7.41 billion citizens in developing countries depend, to an extent, upon agriculture and its prosperity (Gouda et al. 2018). Agricultural business, on one hand, produces human food, fibre, and fuel to meet increasing needs of the population; on the other hand, it places significant pressure on natural resources that benefit many countries. One of the main tasks of agriculture around the world is to reconcile the increasing demand for food

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with sustainable tillage practices (FAO 2017; Calicioglu et al. 2019). According to forecasts, the world's population will increase to about 9 billion in 2030 and to 10 billion in 2050 (DESA 2017). A sharp rise in the population will require a significant growth of food production (by 50% until 2030 and by 70% until 2050) (FAO 2011). Thus, agricultural business needs to adopt new practices that enable production efficiency, reducing pressure on natural resources, at the same time. The latter is extremely important for agriculture having to deal with depletion of non-renewable natural resources, soil damage, harmful effects of chemicals on human health and the environment, poor food quality (Singh et al. 2019). This stimulates increasing interest in sustainability models from agricultural enterprises (Van Thanh/Yapwattanaphun, 2015), especially those that strive for leadership to ensure better business and the world (BSDC 2017).

This is also true for Ukrainian agricultural businesses, mostly small and medium enterprises that have utilized growing market opportunities to achieve sustainability goals (Burkinsky et al 2015). In the global ranking, Ukraine is the sixth country owning 43.37 million hectares or 2.31% of the world arable lands. Its capacity exceeds agricultural potential of any European country having arable lands. According to the State Statistics Committee of Ukraine, at the end of 2019 there were 68 thousand agricultural business entities in Ukraine, utilizing a wide range of farming practices, from conventional to organic, and fast-growing market opportunities (SSCU 2021).

Accelerating sectoral shift to sustainable development models requires transformation of the business operations and incorporating sustainability concept into its strategy (BSDC 2017). However, many scientists emphasize difficulties in interpreting and conceptualizing sustainable development in agriculture (Velten et al. 2015; Laurett et al. 2020). To fill the gap, the research into the views of scientists and agricultural producers on sustainable development was conducted. The latter are the actors who really introduce sustainable practices in their economic activity, whereas scientists have a range of tools to influence the behaviour of agricultural producers (Feola et al. 2015). Smith and Sullivan suggest that deeper understanding of how sustainability is perceived by different actors, including agricultural producers, could serve to improve the mechanism that can influence their behaviour through counselling, seminars run by scientists and specialists in this field (Smith/Sullivan 2014).

There are a limited number of studies that focus on sustainable practices in agriculture and their application in the industry (Foguesatto et al. 2020). Some of them reveal obstacles or barriers that agricultural producers experience when implementing more sustainable practices (Kata/Kusz, 2015; Laurett et al. 2020). Other researches investigate possible effects of sustainable development in agriculture (Laurett et al. 2020; Martin et al. 2015). As a follow-up to previous researches, our study aims to identify the views of scientists and agricultural

producers on sustainable development, barriers it may face and consequences of it in Ukraine in order to outline the perspective shifts of business models and strategies capturing the global sustainable goals.

2. Theoretical background

2.1. Sustainable development in agriculture

The term 'sustainability' became widespread after the report of Brundtland (1987). She proposed a new model of economic growth aimed at meeting human needs of present and future generations (Brundtland 1987: 14). The second important framework fostering the development of the idea of sustainability was the Triple Bottom Line (TBL) concept, originated by John Elkington. He proposed to analyse sustainable development from social, economic and environmental perspectives (Elkington 2004). In addition to these basic concepts, various authors have proposed more than 300 definitions that reflect different dimensions of sustainability (Washington 2015). They also consider opportunities for achieving the 17 Sustainable Development Goals (SDGs), ranging from poverty eradication to creation of international partnerships, in the UN member states (UNDP 2016) by December 2030. It is suggested that sustainable development can be implemented in different ways depending on the country, local context, and sector.

The Food and Agriculture Organization (FAO) of the United Nations views sustainable agriculture as management and conservation of the natural resource base, as well as the focus on technological change that will ensure satisfying the needs of present and future generations (FAO 2017). According to FAO's vision, sustainable agriculture preserves land, water, genetic resources of plants and animals. It is environmentally non-degrading, technically appropriate, economically viable and socially acceptable (FAO, 2011). This approach requires agricultural producers to use appropriate practices and methods that will help preserve biodiversity and natural resources, and thereby ensuring the sustainable existence of millions of people (SANs, 2021).

According to opinion of Sustainable Agricultural Network experts, new approaches should strengthen both business (generate profit, increase sustainability) and society (create positive externalities for the environment, community, and employees) (SANs, 2021). There are a number of studies making attempts to research sustainable agricultural development in the context of different agricultural practices (or systems), such as organic production (Seufert et al. 2012); conservation agriculture (Kienzler et al. 2012); biological production (Mzoughi 2011); eco-production (McNeely/Scherr, 2003); sustainable intensification (Bernard/Lux 2017). The attempts to develop a comprehensive approach to the definition of sustainable development in agriculture have been unsuccessful due to complexity of the concept and the need to adapt it to the specific

context of agriculture. Several attempts in the field have been made by Ukrainian scientific community (Samofatova 2018; Uzhva 2017; Burkinsky et al 2015). In particular, authors suggest that sustainability is the capacity of a system to withstand change and maintain a certain dynamic balance (Burkinsky 2015). Uzhva considers optimal territorial and industry structure to ensure sustainable development (Uzhva 2017).

2.2. Barriers to sustainable development

A significant number of recent researches are aimed at identifying barriers to agricultural sustainability. Among the main ones is the lack of financial resources (Kata/Kusz 2015; Cederholm 2018). Implementation of sustainable practices requires new knowledge, appropriate technologies, certification of organic substances, and, consequently, significant investment (Ma et al. 2009). In addition, more sustainable agricultural production increases production costs and reduces profitability in the short run. Another barrier to the implementation of principles of sustainable development is the consumer themselves. Sustainable development is about responsible consumers who agree to pay more for eco-friendly goods because they realise their benefits (Martin et al. 2015). However, more often consumers refuse to purchase expensive eco-products (Padel/Foster 2005).

One more barrier to sustainable production is certification, which, on the one hand, can help improve product quality, on the other hand is subject to numerous rules and obligations because of the necessity to deal with certification bodies (Kata/Kusz 2015). In addition, the transition to principles of sustainable development is not always accompanied by the necessary state support (Cederholm 2018).

Other barriers identified are the following: the lack of sufficient information and consulting, limited technical knowledge of alternative production methods (Martin et al., 2015; Kata/Kusz, 2015). Researchers also note the lack of technical support or specialised (advisory) assistance (Cederholm 2018), as well as legislation that would facilitate the transition to the production of sustainable products, sold at a higher price (Cederholm 2018).

2.3. Consequences of sustainable development

Today, there is a small amount of research on the effects of sustainable development in agriculture. One of the consequences of the introduction of sustainability in the agricultural sector is a change in profitability. Some researchers have found an increase in profitability after the introduction of sustainable practices (Martin et al. 2015). Others note declining profitability (Kata/Kusz 2015). However, profit seems to be raised only in the long run. In the short run,

sustainable agriculture results in increased production costs (Kata/Kusz 2015). Prices for all eco-products in the sector cannot be set high enough until a special culture of consumption is developed. More obvious consequences are improving efficiency in the use of natural resources, increasing soil fertility, and reduced pollution of soil, air and water, therefore conservation of natural resources. (Marcelino-Aranda et al. 2017).

3. Materials and Methods

Two surveys were conducted in 2021–2022. Firstly, in order to organise the exploratory (qualitative) study necessary data was collected through the method of a semi-structured interview. Researchers usually refer to the method when they need to gather in-depth insights into the perceptions, attitudes and opinions of people with appropriate experience in the field (Preissel et al. 2017). Hence, the interviews with the Ukrainian agricultural producers (owners and managers of small and medium-sized enterprises), who relate their businesses to sustainable practices, were organised. The sample covered different regions of Ukraine. Only some of the farmers questioned were eco-certified. Potential respondents were explained the purpose of the study and asked if they could participate in the interview. The sample size was large enough to clarify the researched phenomenon (Hagaman/Wutich, 2016). The average duration of the interview was 35 minutes. The questions concerned the practices of sustainable development employed by respondents in their businesses, barriers and consequences they can observe. Previously, the interview was tested on two respondents. To ensure anonymity, respondents were marked from P1 to P19. Surveyed producers specialise in growing different crops (wheat, sunflower, corn, vegetables, legumes, fruits), and some farms are engaged in animal husbandry. NVIVO software was used to analyse the interviews (Laurett et al. 2020).

Based on the content analysis, we have found out how sustainable development is defined by actual producers operating in agriculture in Ukraine (1), what barriers to the implementation of relevant practices (2) and consequences for the sector (3) they can see. Almost all statements of farmers are correlated with existing theoretical developments in this context.

In the second phase of the study, a questionnaire was developed and the scientific community was approached to assess whether they agree or disagree with the statements proposed by agricultural producers on a 5-point Likert scale (for instance, “evaluate whether you agree with the definition of “sustainable development of agriculture in Ukraine” on a 5-point Likert scale from 1 to 5, where 5 – strongly agree; 1 – strongly disagree” – “sustainable development is a process of progressive social change” (Q2, Table 1). 157 scientists in different fields of study (agricultural sciences, including economics and management, ecology) from all over Ukraine took part in the survey. The sample included

scientists who focus their study on sustainability in agriculture. The research population is 1500 scientists. The stratified sampling covers 10% of the whole number (Barnett 2002). The access to experts was provided through scientific communities, associations, universities. 142 questionnaires were found suitable. Finally, statistical analysis was utilised to identify agreed responses on the perception of sustainable development in agriculture, barriers it may face and the consequences of the implementation of relevant practices in Ukraine. Principal factor analysis with a Varimax rotation was used to explore the structure underlying qualitative items that describe different dimensions of sustainable development in agriculture (Velten et al. 2021). The adequacy of the exploratory factor analysis was determined through the Bartlett's test and the Kaiser-Meyer-Olkin (KMO) measure. The inclusion of the items to describe a dimension was determined iteratively, based on factor loadings ≥ 0.6 and Cronbach's alpha coefficients ≥ 0.7 (acceptable rate). Processing was performed using the SPSS 25 package (Velten et al. 2021).

4. Results and Discussions

4.1. Sustainable agriculture: definitions

Johnston et al. (2007), addressing the issue, note that the general concept of sustainable development should be explored in the context of the industry. Thus, firstly, it has been determined how agricultural producers in Ukraine perceive sustainable development.

Interviewees (P1, P2, P3, P4, P5, P7, P8, P9, P11, P12, P14, P15, P18) suggest that sustainable development in agriculture cannot occur without science and requires the introduction of sustainable practices based on knowledge in agronomy, biochemistry, biology. Sustainability in the sector is based on the knowledge of proper use of organic fertilizers to grow eco-friendly products for the local population. Most enterprises which follow the principles of sustainability in Ukraine focus on production of goods specifically for the local consumer who tends to choose healthier products. If an enterprise increases production, it requires the purchase of modern equipment, technologies that ensure a product quality and compliance with the requirements of international certification in the case of exports. Thus, the implementation of sustainable practices requires innovative approaches and technologies in production. Some agricultural producers (P1, P2, P3, P4, P5, P9, P11, P12, P14, P15, P17) support the above-mentioned statement and suggest that sustainable development is a constant growth of the system's potential that can meet consumer needs for goods based on the optimal territorial and industry structure.

In addition, agricultural producers (P2, P4, P11, P12, P13, P15, P17, P18, P19) note that production of environmentally friendly goods requires the building of a new culture in which the consumer is willing to pay more for an eco-product.

When dealing with fruit and vegetables, agricultural producers in Ukraine have the opportunity to sell them at market prices in order to get the expected profits. And the reputation of farmers or brands contributes significantly to the promotion of their products on the market. Agricultural producer P13 mentioned: "… business can certify eco-products in Ukraine and receive the label "eco", which confirms the use of organic fertilizers in the production".

Almost all producers state that a business can be transformed into a sustainable one if it generates stable profit and income. The producer P19 noted: "…businesses that change the approach to production are subjected to the transition period in order to produce environmentally friendly goods, and it can last up to three years". This explains why traditional business has to be profitable to build sufficient capital to invest in sustainable practices and technologies. Sustainable business with the focus on social responsibility also bares high costs to ensure sufficient wages for its employees and retain them in the field.

Agricultural producers (P1, P2, P3, P4, P6, P7, P11, P12, P16, P17, P18) also associate sustainability with conservation of natural resources, in particular, land, water and energy. Producers P6, P11, P12, P15, P16 mentioned that "the majority of middle-sized enterprises grow three or four main crops (mainly wheat, corn and sunflower), profitability of which can exceed 100%". However, this system of agriculture differs from the eight-field crop rotation, which was used in Ukraine for a long time in the past and fostered natural mechanisms of pest and weeds control as well as soil restoration. However, producers P1, P2, P3, P4, P5, P6, P11, P12, P15, P17, P18 note that efficient agricultural production involves preservation of nutrients in the soil by applying a required amount of mineral fertilizers to maintain yields, but the use of synthetic agrochemical compounds is limited in sustainable eco-production practices.

Producers P1, P2, P4, P11, P12, P13, P15, P16, P17 also emphasise the need to introduce environmental and agronomic management, one of the main functions of which is product quality control and monitoring of the fields. In particular, P15 mentioned: "…based on the obtained data, the effectiveness of applied agricultural technologies is analysed in order to improve the system as a whole".

Thus, based on the content analysis, we have made the conclusion that all the practices of sustainability outlined through the interview are correlated with the definitions of scholars and the "Green Deal" organisations. Table 1 represent different sustainability characteristics. It is remarkable that a small number of producers (P5, P7, P13, P19) associate sustainable agricultural development with limited economic activity and reduced consumption of resources and goods (P1, P3, P8, P14).

4.2. Barriers to sustainability in agriculture

The literature review suggests that difficulties in understanding what sustainable development is constitute one of the main obstacles to implementation of sustainability in agriculture and other sectors of the economy (Laurett et al. 2020). Through interviewing, various types of barriers which prevent Ukrainian producers from making agriculture more sustainable were identified (see Table 2).

Firstly, agricultural producers (P2, P3, P4, P5, P6, P7, P12, P14, P15, P17, P18, P19) state that the main limiting factors on the way to sustainable business are the lack of state policy and support at both national and regional levels. For instance, existing development strategies do not set sustainable goals for agriculture, and the issue of production of environmentally friendly products, which ensure healthy nutrition, still is not given due attention in Ukraine.

In addition, producers (P2, P7, P11, P12, P14, P17, P18, P19) point to the fact that a traditional approach to management allows them to grow crops with a profitability of more than 100%. Therefore, they are not interested in implementation of sustainable practices as the latter generate much less profit in the short term. In a sense, enterprises are dependent on the use of mineral fertilizers, pesticides and other chemicals to maintain yields and restore soil nutrients (P2, P3, P6, P7, P8, P11, P14, P18, P19). In this regard, the introduction of state programs aimed to compensate for the decline in profitability at the initial stage is extremely important.

Table 1: Definitions of sustainable development in agriculture in Ukraine, provided by producers

Definition of sustainable development	Agricultural producers	Previous research
Sustainable development		
is the technology leadership and innovation (Q1)	P3, P4, P7, P8, P9, P11, P12, P14, P17	-
is a process of progressive social change (Q2)	P1, P3, P4, P7, P8, P11, P15, P17, P18	Samofatova V. A., 2018
is the conservation of the natural resource base to ensure the attainment of continued satisfaction of human needs for present and future generation (Q3)	P1, P2, P3, P4, P6, P7, P11, P12, P16, P17, P18	Bastan et al. 2018
is environmentally non-degrading, technically appropriate, economically viable and socially acceptable process (Q4)	P1, P2, P3, P4, P5, P6, P7, P11, P12, P14, P15, P16	FAO 2011
contributes to biodiversity (conserves plant and animal genetic resource) while ensuring the sustainable livelihoods for the millions of people (Q5)	P1, P2, P3, P4, P6, P7, P11, P12, P14, P17	Sustainable Agriculture Network
contributes to limitations on human activities (Q6)	P5, P7, P13, P19	Pope et al. 2004
generates profits for business and positive externalities for the environment, communities, employees (Q7)	P1, P2, P3, P4, P5, P7, P11, P12, P14	Latruffe et al. 2016
encourages minimizing of consumption, or imposes personal and institutional quotas on energy, goods, water (Q8)	P1, P3, P8, P14	Jackson 2009

Definition of sustainable development	Agricultural producers	Previous research
is a closed-loop system where nothing is allowed to be wasted or discarded into the environment, which reuses, repairs, and re-makes in preference to recycling (Q9)	P1, P2, P3, P4, P5, P6, P11, P17, P19	Jackson 2009
is the transformation of human lifestyle that support security, well-being, and health, particularly by maintaining the supply of non-replaceable goods / services (Q10)	P1, P2, P4, P5, P6, P11, P12, P14,P16, P18, P19	McMichael et al. 2003
is the optimal ratio between economic growth, normalization of natural environment, growth of material and spiritual needs of people (Q11)	P1, P2, P3, P4, P5, P11, P12, P14, P15, P17	Danylyshyn et al. 1999
is the capacity of a system to withstand change and maintain a certain dynamic balance (Q12)	P1, P2, P4, P5, P11, P12, P16, P17, P18	Burkinsky et al. 2015
is a permanent growth of the system's potential aimed at meeting human needs for goods based on optimal territorial and industry structure (Q13)	P1, P2, P3, P4, P5, P9, P11, P12, P14, P15, P17	Uzhva 2017
is a responsible consumer who is able to pay more for eco-friendly goods (Q14)	P2, P4, P11, P12, P13, P15, P17, P18, P19	Martin et al. 2015
Sustainable agriculture		
is an organic or diversified farming that enhances the richness and abundance of species (Q15)	P1, P2, P3, P4, P6, P11, P12, P15, P16	Zeweld et al. 2017
aims to provide enough food for a growing population without compromising the environment livelihoods (Q16)	P1, P2, P3, P4, P6, P11, P12, P15,P16, P17	UNDP 2016
is an ecological activity that provides the governmental support of agricultural producers, applying a subsidy of up to 30% of direct payment (Q17)	P2, P4, P11, P12, P17, P18, P19	Alcon 2020
seeks to make the best use of nature's goods and services, technologies and practices that must be locally adapted (Q18)	P1, P2, P3, P4, P5, P11, P12, P14, P17, P19	Clements/Shrestha 2004
suggests the focus on both genotype improvements and implementation of ecological and agronomic management, and redesign (Q19)	P1, P2, P4, P11, P12, P13, P15, P16, P17	Collard/Mackill 2008
biologically integrated agro-ecosystems that focus on the closed-loop cycle of nutrients and energy with few potentially toxic interventions (Q20)	P1, P2, P3, P4, P7, P11, P12, P18, P19	-
requires a diverse and adaptive knowledge base, utilizing both formal, experimental science and farmers' own on-the-ground local knowledge (Q21)	P1, P2, P3, P4, P5, P7, P8, P9, P11, P12, P14, P15, P18	Brodt et al. 2011
reduction of emissions and pollution (Q22)	P1, P2, P3, P4, P5, P7, P11, P12, P14, P18	Romero et al. 2011
use of renewable energy (biodiesel, wind and solar energy, biogas, etc.), its conservation, energy efficiency (Q23)	P1, P2, P3, P4, P6, P7, P11, P12, P17	
reduction of the use of mineral fertilizers, pesticides in dangerous doses (Q24)	P1, P2, P3, P4, P5, P6, P11, P12, P15, P17, P18	Martin et al. 2015
waste reduction (Q25)	P2, P3, P4, P5, P7, P11, P12, P14, P18	Romero et al. 2011

Source: Own design on the basis of conducted interview

Agricultural producers (P2, P3, P6, P7, P8, P12, P15, P17) also note that the lack of technical knowledge and the current system of agricultural consultancy are also serious barriers to sustainable development. From time to time with the financial support of USAID, Ukrainian Business Trade Association (UBTA) holds trainings and seminars for producers interested in sustainability (Agricul-

tural and Rural Development Program). However, sustainable development in agriculture needs a lot of local technical support. It can be especially useful for small businesses, which can't afford to hire professionals with the necessary knowledge and relevant experience to build a sustainable production system. At the same time, producers are to be ready for continuous training on sustainability with further consistent implementation of necessary changes. In particular, producer P13 noted: "…many years of experience in building a sustainable business can be useful to support nascent entrepreneurs in this area through consulting and mentoring".

Another factor that hinders the introduction of sustainable production (P2, P3, P4, P5, P6, P7, P11, P17) is weather conditions, which vary significantly among regions of Ukraine. For instance, the Lviv region is characterised by high levels of humidity and annual rainfall. As a result, enterprises have to use an increased amount of organic mineral fertilizers to support plants, which significantly increases production costs.

Table 2: Barriers to sustainable development in agriculture, identified by producers

Definition of barrier	Agricultural producers	Previous research
Lack of information and technical knowledge about sustainability in agriculture (Q26)	P2, P3, P5, P7, P8, P11, P12, P14, P17, P18, P19	Martin et al., 2015
Difficulty in obtaining certification of sustainable production (Q27)	P2, P4, P5, P11, P15	Kata & Kusz, 2015
Lack of government support, including at the strategic level (Q28)	P2, P3, P4, P5, P6, P7, P12, P14, P15, P17, P18, P19	Cederholm, 2018
Lack of legislation and specific regulations to make agriculture more sustainable (Q29)	P2, P4, P5, P6, P7, P8, P11, P12, P17, P18, P19	Laurett et al., 2020
Lack of technical support or consulting (Q30)	P2, P3, P6, P7, P8, P12, P15, P17	Martin et al., 2015
A culture of globalized consumption (Q31)	P2, P3, P4, P7, P8, P11, P15, P17, P18	Duarte, 2015
Lack of financial resources to invest in sustainability (32)	P2, P4, P5, P6, P7, P8, P11, P12, P15, P16, P18	Kuppig et al., 2016
Dependence on pesticides and other mineral fertilizers (Q33)	P2, P3, P6, P7, P8, P11, P14, P18, P19	-
Resistance to behaviour change (producers, consumers) (Q34)	P2, P3, P6, P7, P11, P17, P18, P19	Cederholm, 2018
Weather conditions (Q35)	P2, P3, P4, P5, P6, P7, P11, P17	-
Lack of trainings and seminars on sustainable development (Q36)	P2, P3, P6, P11, P12, P15	Stewart et al., 2016
Increased production costs (Q37)	P2, P3, P4, P5, P8, P11, P13, P15 P18, P19	Laurett et al., 2020
Traditional management that hinders sustainable practices (Q38)	P2, P7, P11, P12, P14, P17, P18, P19	Cederholm, 2018

Source: Own design on the basis of conducted interview

In addition, producers (P2, P4, P5, P6, P7, P8, P11, P12, P15, P16, P18) note that expansion of sustainable production requires financial resources, which are quite limited to small and medium-sized business in Ukraine. In particular, only large enterprises have access to investment and credit resources. And no special

programs for small and medium-sized firms are being currently offered. The barriers mentioned by agricultural producers are presented in Table 2, most of them were found by existing studies in this field.

4.3. Consequences of sustainable development in agriculture

Among the consequences of sustainable development in agriculture, producers have identified the following (see Table 3).

Table 3: Consequences of sustainable development in agriculture, identified by producers

Definition of consequence	Agricultural producers	Previous research
Long-term profitability (Q39)	S1, S2, S3, S4, S5, S6, S7, S9, S11, S13, S15, S19	Marcelino-Aranda et al., 2017
Conservation of natural resources (Q40)	S1, S2, S3, S4, S7, S12, S15, S17, S19	Laurett et al., 2020
Production of healthier food (Q41)	S1, S2, S3, S4, S8, S9, S12, S15, S18, S19	-
Increased efficiency in the consumption of natural resources (Q42)	S1, S2, S3, S4, S5, S6, S9, S11, S15, S16	Martin et al., 2015
Increased fertility of the soil (Q43)	S1, S2, S5, S6, S9, S15,	-
Reduced soil, air and water pollution (Q44)	S2, S3, S4, S6, S7, S10,S12, S13, S15, S18, S19	Laurett et al., 2020
Improved quality of life for farmers and their families (Q45)	S1, S2, S3, S4, S7, S9, S11, S14, S18	Laurett et al., 2020
Sustainability makes a feeling of personal satisfaction (Q46)	S1, S2, S3, S4, S7, S9, S11, S14, S15, S16	Laurett et al., 2020
Job creation (Q47)	S1, S2, S4, S5, S7, S12, S14, S15, S18	-

Source: Own design on the basis of conducted interview

4.4 Sustainable development in agriculture in Ukraine

Thus, the interview gave the possibility to outline the characteristics and practices of sustainable development in agriculture of Ukraine, its barriers and consequences, which are consistent with those formulated by scientists and organisations working in the field. However, some barriers to sustainable development noted by agricultural producers (weather conditions, dependence on pesticides, other mineral fertilizers), and possible consequences mentioned in the interviews (healthier food, increased fertility of the soil, and job creation) are specific to certain regions only.

Further, all the formulated statements were proposed to scientists (experts in sustainable development in agriculture) so they could assess on a 5-point scale whether these practices, barriers and consequences are inherent in agriculture in Ukraine (for instance, “evaluate whether you agree with the definition of “sustainable development of agriculture in Ukraine” on a 5-point Likert scale from 1 to 5, where 5 – strongly agree; 1 – strongly disagree).

Means, standard deviations, standard errors are presented in Table 4. The results show that the last thing scholars and agricultural producers associate sustainable

agricultural development with is the restriction of economic activity (Q6) and minimization of consumption of resources and goods (Q8). In addition, scholars do not associate sustainable development of agriculture with the optimal territorial and sectoral structure (Q13).

Table 4: Experts' opinion on sustainable development in agriculture

Q_n	Mean	SD	SE Mean	Q_n	Mean	SD	SE Mean
Q3	4,602	0,715	0,0784	Q19	4,022	1,164	0,1222
Q4	4,530	0,738	0,0810	Q9	4,000	1,044	0,1096
Q5	4,518	0,739	0,0811	Q14	3,923	1,148	0,1203
Q22	4,506	0,722	0,0793	Q11	3,868	1,098	0,1151
Q18	4,484	0,751	0,0787	Q2	3,846	1,154	0,1210
Q23	4,440	0,778	0,0815	Q15	3,780	1,143	0,1272
Q25	4,410	0,733	0,0805	Q7	3,714	1,214	0,1295
Q10	4,330	0,831	0,0871	Q1	3,691	1,236	0,1295
Q24	4,330	0,804	0,0842	Q21	3,571	1,066	0,1118
Q12	4,319	0,729	0,0764	Q13	3,264	1,272	0,1334
Q17	4,209	0,809	0,0849	Q8	3,220	1,340	0,1405
Q16	4,157	0,788	0,0865	Q6	2,615	1,306	0,1365
Q20	4,088	0,996	0,1044				

However, Ukrainian scientists associate sustainable development with the conservation of natural resources for the needs of present and future generations. It is characterised as environmentally non-degrading, technically appropriate, economically viable and socially acceptable process, as well as one that contributes to the preservation of biodiversity (plant and animal genetic resource), ensuring the sustainable livelihoods for the millions of people. Ecological dimension of sustainable development is associated with reduced emissions and pollution. Experts in sustainability point out that sustainable agriculture requires application of technologies and best management practices adapted at the local level, as well as the use of renewable energy sources, energy efficiency, and waste reduction.

In addition to sustainable practices in agriculture, barriers to sustainable development of the industry were assessed in the study. Descriptive statistics are presented in Table 5. Among the barriers identified by scholars and experts in the field of sustainable development are the following: the lack of state support, the lack of financial resources to invest in sustainability, and the lack of effective legislation fostering sustainable practices in agriculture. Factors such as difficulties in certifying eco-production, increased production costs, traditional management and others received an average score of 3.6.

Table 5: Experts' opinion on barriers to sustainability in agriculture

Q_n	Mean	SD	SE Mean	Q_n	Mean	SD	SE Mean
Q28	3,967	1,048	0,1099	Q35	3,637	0,140	0,1195
Q32	3,912	1,082	0,1134	Q37	3,637	1,207	0,1265
Q29	3,846	1,135	0,1189	Q34	3,626	1,161	0,1217
Q27	3,670	0,967	0,1013	Q26	3,527	1,058	0,1109
Q38	3,659	1,240	0,1300	Q30	3,462	1,285	0,1347
Q39	3,648	1,187	0,1244	Q33	3,286	1,232	0,1291
Q31	3,648	1,177	0,1234	Q36	3,132	1,087	0,1140

Additionally, the consequences of sustainable development in agriculture were outlined (see Table 6). Experts assessed almost all ones rather high. In scholars' view, the most probable consequences are the following: more efficient use of natural resources, reduced soil, air and water pollution, therefore, conservation of natural resources, production of environmentally friendly food, increased soil fertility and improved quality of life for farmers.

Table 6: Experts' opinion on consequences of sustainability for the agricultural sector

Q_n	Mean	SD	SE Mean	Q_n	Mean	SD	SE Mean
Q43	4,604	0,665	0,0697	Q46	4,132	0,897	0,0940
Q45	4,571	0,635	0,0665	Q47	3,978	1,135	0,1190
Q41	4,571	0,705	0,0735	Q48	3,868	1,058	0,1109
Q42	4,407	0,730	0,0765	Q40	3,824	1,147	0,1202
Q44	4,308	0,785	0,0822				

In order to develop the concept of sustainable development of agriculture an exploratory factor analysis was done. Principal factor analysis with a Varimax rotation was used to explore the structure underlying the 25 qualitative items which describe different dimensions of sustainable development. The set of definitions of sustainable agricultural development suggested by agricultural producers in the context of Ukraine is classified according to the scholars' assessments. Items 6, 8 and 13 were not used for the analysis. The value of KMO is 0.867 denoting high adequacy of the factor analysis. In addition, the Bartlett's criterion is <0.001 (Chi-square = 1157.9), which indicates the applicability of factor analysis. All definitions of sustainable development have Pearson correlation coefficients > 0.5, which is the basis for their further use to identify possible dimensions.

The exploratory factor analysis of the 25-item questionnaire identified five groups of factors, which explain 71.4% of the variance in the data. Five dimensions (groups of factors) reflect different aspects of sustainability in agriculture

of Ukraine. Based on the original items, which reflect the dimensions, the names were assigned (see Table 7).

Table 7: Dimensions of sustainability of agriculture in Ukraine

Items	Five-factor model				
	Dimensions				
	Balanced ratio	Environmental	Economical	Social and Eco-logical	Progressive changes
Q21	**0,734**	0,126	0,211	0,243	0,101
Q11	**0,710**	0,195	0,195	0,114	0,274
Q12	**0,625**	0,301	-0,127	0,172	0,265
Q16	**0,699**	0,259	0,112	0,228	0,276
Q24	0,343	**0,735**	-0,008	0,032	0,290
Q22	0,100	**0,768**	0,217	0,262	0,028
Q25	0,286	**0,746**	0,128	0,096	0,071
Q23	0,226	**0,693**	0,163	0,337	0,110
Q20	0,301	0,091	**0,776**	0,035	0,017
Q7	0,065	0,029	**0,733**	0,231	0,319
Q18	0,064	0,323	**0,598**	0,310	0,120
Q19	0,490	0,204	**0,516**	0,459	-0,043
Q17	0,351	0,217	**0,507**	0,136	0,207
Q15	0,140	0,483	**0,716**	0,140	0,216
Q9	0,342	0,154	0,175	**0,701**	-0,018
Q5	0,140	0,208	0,165	**0,695**	0,394
Q10	0,547	0,285	0,006	**0,619**	0,008
Q3	0,086	0,248	0,020	**0,635**	0,403
Q4	0,040	0,098	0,304	**0,606**	0,326
Q14	0,004	0,206	0,413	**0,528**	-0,022
Q2	0,251	0,101	0,080	0,230	**0,798**
Q1	0,220	0,124	0,429	0,132	**0,626**
Cronbach's alpha	**0,770**	**0,858**	**0,810**	**0,818**	**0,742**

Extraction method: Principal factor analysis. Rotation method: Varimax rotation with Kaiser standardization.

The first dimension contains the items of sustainable development which characterise the balanced ratio of certain aspects of agricultural system. It includes the items Q21, Q11, Q12 and Q16, which describe optimal ratio between economic growth, normalization of natural environment, the growth of population needs. The second dimension characterises the environmental aspects of sustainability and involves the items Q22, Q23, Q24, Q25. The third dimension contains

economic factors (items Q7, Q15, Q17, Q18, Q19, Q20), which describe the use of natural resources, technologies, and best practices adapted at the local level, the internal cycle of nutrients and energy with fewer potentially toxic interventions. The fourth dimension characterises the factors that reflect a socio-ecological aspect of sustainable agricultural development, and includes the items Q9, Q5, Q10, Q3, Q4, Q14. It describes a responsible consumer, a closed-loop system, conservation of biodiversity, safety, well-being, and the health of the population. The fifth dimension of progressive changes contain the following characteristics: (Q1) sustainable development is technological leadership and innovation (Q2), as well as a process of progressive social changes.

The analysis enriches a three-dimension concept of sustainability and suggests such additional components for agricultural development as balance ratio and progressive changes. In this context, small and medium-sized enterprises in Ukraine should embrace new business models, which are not only environmentally and socially sustainable, as well as profit-oriented, but also able to increase productivity and utilization of innovation-driven resources through incorporation of a balanced approach to achieving sustainable goals into their operating strategies (BSDC 2017). This management approach means balancing growth in demand and limited consumption, high profits and necessary investments in sustainability (safety, working conditions, salary), experimental science and farmers' on-the-ground knowledge.

5. Conclusions

In order to develop the concept of sustainable development of agriculture, its consequences and barriers to its implementation, interviews with 19 small and medium-sized agricultural producers in Ukraine were conducted. We have identified that the Ukrainian producers perceive sustainable development in agriculture in the context of the 25 most common definitions that characterise application of various sustainable practices and technologies adapted at the local level. The surveyed agricultural producers named 13 barriers that hinder the introduction of more sustainable practices in the economy. Finally, they have mentioned nine consequences more sustainable production may have, including benefits that agricultural producers will receive with the implementation of sustainability principles in their economic activity.

The next stage of the study included a survey of the scientific community. In particular, 142 experts on sustainable development in agriculture assessed on a 5-point scale whether identified practices are inherent in the agriculture of Ukraine. Based on the content analysis of the responses of agricultural producers as well as the statistical analysis of scholars' responses, we have identified additional dimensions of sustainable business development, which suggests progressive changes and incorporating balanced social, economic, and ecological goals

into their operating strategies. Thus, this study contributes to the enrichment of the concept of sustainable development in agriculture given its complexity (Velten et al. 2021; Laurett et al. 2020). The study also develops knowledge about sustainability in Ukrainian context and enriches existing theoretical background (Uzhva 2017; Burkinsky et al 2015).

The research has practical implication. Based on the concept, enterprises should change their prospects by offering new socially and environmentally oriented business models. Most business leaders should consider sustainability as more than corporate social responsibility as it boosts reputation by sharing profits with community and contributing to ecological projects, promotes cooperation with politicians to ensure perceived fair pay for natural and human capital, supports the development of a financial system focused on long-term investment sustainability (Velten 2021). Switching to sustainable development in agriculture means implementation of the approach balancing growth in demand and limited consumption, high profits and necessary investments in sustainability (safety, working conditions, salary), experimental science and farmers' on-the-ground knowledge. In other words, achieving sustainable goals in a balanced way. On the other hand, the rationale for sustainable development is to open up new opportunities and gain significant growth in productivity and innovation-driven resources, which in turn, improves reputation (BSDC 2017). The dimension of progressive changes is less pronounced in the study, but it relates to technological leadership and progressive social changes, which form the basis for rapid growth.

The results of this study gained from interviews with the Ukrainian agricultural producers could also contribute to the design of local programmes aimed to support sustainable development of small and medium-sized business.

The limitation of the research is the sampling, which represents small and medium-sized business in Ukraine and their perception of sustainable development in agriculture. Accordingly, there may be other definitions of sustainable development, as well as other barriers and consequences that were not mentioned by the agricultural producers surveyed, who mostly represent conventionally operating businesses.

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